

Aerobic Bioremediation of a Contaminated Aquifer

A protocol for predicting air sparging system performance

Air sparging is the process of injecting clean air directly into an aquifer for the remediation of contaminated groundwater. In situ air sparging remediates groundwater through a combination of volatilization and enhanced biodegradation. The induced air transport through the groundwater removes the more volatile and less soluble contaminants by physical stripping. Increased biological activity is stimulated by increased oxygen availability.

THE NEED:

Air sparging is being implemented by a number of practitioners. However, available data to date have been insufficient to address key questions such as: (1) the degree of remediation can be achieved by air sparging; (2) the influence of soil heterogeneities and contaminant type on the rate and extent of treatment; (3) the role and significance of biodegradation/oxygenation, volatilization, and mixing processes; (4) the use of short-term pilot-test data to assess feasibility and design full-scale systems; and (5) the influence of changes in design parameters and operating conditions on treatment effectiveness.

THE SITE:

To answer such questions, a site was selected at the SERDP-funded Hydrocarbon National Test Site (NTS), managed by the Naval Facilities Engineering Service Center (NFESC), Port Hueneme, CA. At the Naval Construction Battalion Center on the NTS, a leaking underground gasoline storage tank contaminated a shallow water aquifer. An estimated 10,800 gallons of gasoline leaked into the subsurface.

Two air sparging sites were established to monitor and assess contaminant removal rates involving different and changing environmental parameters. One site is located in the residual-phase contamination zone of the gasoline plume; the other site is in the dilute-phase portion of the plume.

THE SYSTEM:

Each air sparging system at the NTS consists of one sparge well screened entirely below the water table, 12 multilevel sampling and neutron access tubes; six monitoring/soil vapor extraction (SVE) wells, and four SVE directional wells. The strategic location of the monitoring wells throughout the site will capture the best representation of what is occurring within a 30-foot radius of each sparge well.

Extensive site characterization of soil and groundwater was performed to determine the concentration of contaminants in the soil and groundwater. These data will give a solid baseline from which analysis of in situ air sparging will be conducted throughout the duration of the experiment.

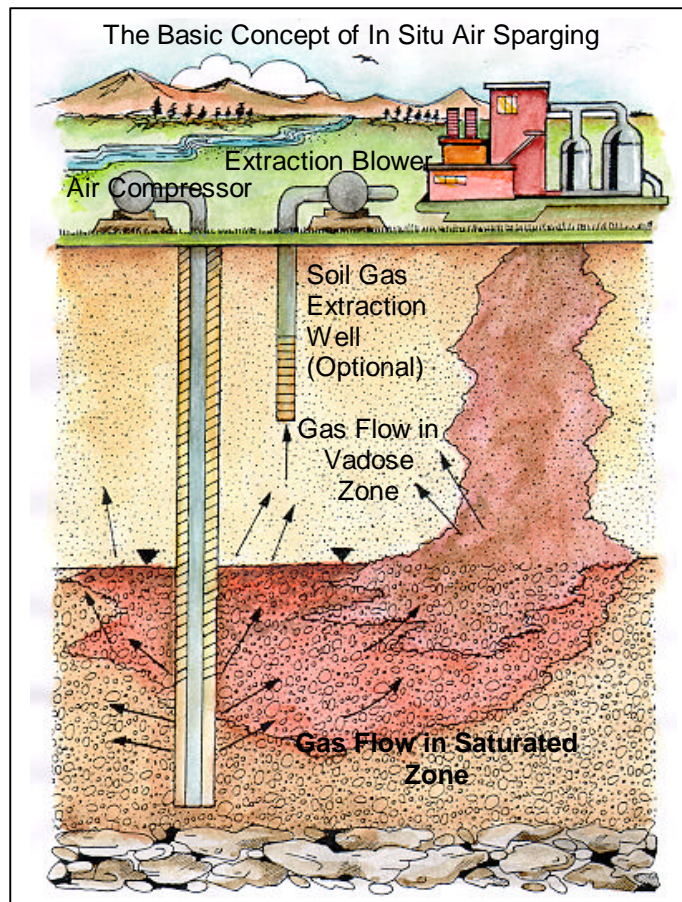
SYSTEM ANALYSIS:

Data generated from separate innovative monitoring techniques will be compared to determine which quantitative methods most accurately represent the changing site conditions and remediation progress. The project utilizes several standard and innovative monitoring techniques: chemical contaminant measurements; dissolved oxygen measurements;

geophysical measurements such as neutron probe, electrical resistance, cross-borehole radar, and Troxler probe; and tracer measurements using helium and sulfur hexafluoride.

THE GOAL:

Many practitioners are applying air sparging; however, the behavior of sparging air introduced below the water table has not been studied in detail. Information on the distribution and flow configuration of the injected sparging air is essential to interpreting the performance of air sparging systems and evaluating their potential applicability. This project will provide some of the information needed to understand air sparging systems and to develop a protocol for predicting air sparging system performance. The ESTCP is funding AFRL/MLQ for a three-year field evaluation of this protocol at five sites with operational air sparging systems. This evaluation began in April 1998.



POINTS OF CONTACT:

Maj Tim Wiley (AFRL/MLQE)
AFRL/MLQE
139 Barnes Drive Suite 2
Tyndall AFB, FL 32403-5323
tim.wiley@mlq.af.mil

Ph: 850-283-6299
Fax: 850-283-6064

Dr. Andrea Leeson
Battelle Memorial Institute

Ph: 614-424-5942

Ernie Lory (US Navy NFESC)
Navy Hydrocarbon NTS Manager

Ph: 805-982-1299